Provo River Project

The Provo River Project provides a supplemental water supply for irrigation of 48,156 acres of highly developed farmlands in Utah, Salt Lake, and Wasatch Counties, as well as an assured domestic water supply for Salt Lake City, Provo, Orem, Pleasant Grove, Lindon, American Fork, and Lehi, Utah. The key structure of the project, Deer Creek Dam, is located on the Provo River east of the project lands. Other major structures are the powerplant at the dam, the 42-mile Salt Lake Aqueduct and Terminal Reservoir, Weber-Provo Diversion Canal, Duchesne Tunnel, Murdock Diversion Dam, Provo Reservoir Canal Enlargement, Jordan Narrows Siphon and Pumping Plant, and the South Lateral. The Salt Lake Aqueduct and Terminal Reservoir make up the Aqueduct Division; all other features are included in the Deer Creek Division.

PLAN

The Deer Creek Reservoir stores Provo River floodwater, surplus water of the Weber River diverted by the enlarged Weber-Provo Diversion Canal, and surplus water from the headwaters of the Duchesne River diverted by the 6-mile Duchesne Tunnel. Releases from the reservoir for the Aqueduct Division are diverted at the dam into the Salt Lake Aqueduct, which carries water to a point near Salt Lake City to supple ment the city's supply.

The Provo Reservoir Canal takes water from the Provo River at the Murdock Diversion Dam, about 7 miles downstream of the storage dam. This 23-mile-long canal serves the 46,609 acres in the Deer Creek Division. The Jordan Narrows Siphon and Pumping Plant furnishes water from the Provo Reservoir Canal and Jordan River to lands on the west side of Utah Lake and the Jordan River. The South Lateral delivers water supplies from the Jordan Narrows pump to the area south of the pump and west of the Jordan River. Deer Creek Powerplant generates 4,950 kilowatts of power.

Deer Creek Dam and Reservoir

Deer Creek Dam is located on the Provo River about 16 miles northeast of Provo, Utah. It is a zoned earthfill structure 235 feet high with a crest length of 1,304 feet. The dam contains 2,810,000 cubic yards of material and forms a reservoir of 152,700 acre-foot capacity. The spillway is a

concrete chute at the right abutment controlled by two radial gates. The capacity of the spillway is 12,000 cubic feet per second. The outlet works through the left abutment is a concrete-lined tunnel from the trashrack to the gate chamber, where two steel pipes lead to the powerplant. Releases are controlled by two tube valves. The outlet works has a capacity of 1,500 cubic feet per second.

Collection System

The principal features of the collection system are the Duchesne Diversion Dam, Duchesne Tunnel, Weber-Provo Diversion Dam, and Weber-Provo Diversion Canal. The Duchesne Diversion Dam is on the North Fork of the Duchesne River, about 30 miles east of Heber City, Utah. The dam is a rockfill weir, concrete-core wall structure, 23 feet high, with a weir crest length of 270 feet. The 600-cubic-foot-per-second Duchesne Tunnel, which carries water from the diversion dam to the Provo River drainage basin, is horseshoe-shaped, concrete-lined, 9.25 feet in diameter, and 6 miles long.

The Weber-Provo Diversion Dam and Canal, originally a part of the Weber River Project, have been enlarged to supply water from the Weber River to the Deer Creek Reservoir on the Provo River. The dam, located 1 mile east of Oakley, Utah, is a concrete ogee overflow weir with embankment wings, and has a hydraulic height of 19 feet. The canal has a capacity of 1,000 cubic feet per second and a length of 9 miles, consisting of unlined, earth-lined, and concrete-lined sections.

Aqueduct Division

The principal feature of the Aqueduct Division is the Salt Lake Aqueduct, a 69-inch-diameter concrete pipeline 41.7 miles long, with a capacity of 150 cubic feet per second. Through this pipeline flows the domestic water supply for Salt Lake City. Two tunnels are a part of the aqueduct: The concrete-lined, 78-inch-diameter, horseshoe-shaped Alpine-Draper Tunnel which is 15,037 feet long; and the Olmstead Tunnel, identical in cross section with the Alpine-Draper Tunnel, but 3,614 feet long. The concrete terminal reservoir, with a capacity of 122.8 acre-feet, completes the system.

Deer Creek Division

Deer Creek Division structures include Murdock Diversion Dam, a concrete ogee weir structure, 22 feet high; Provo Reservoir Canal, with a diversion capacity of 550 cubic feet per second and a total length of 23 miles, consisting of unlined and concrete-lined sections; the 65-cubic-foot-per-second capacity Jordan Narrows Pumping Plant; and the South Lateral, with a capacity of 40 cubic feet per second and a length of about 4

miles.

Deer Creek Powerplant

The powerplant was constructed on the substructure provided during the construction of Deer Creek Dam, has two 2,475-kilowatt generators, and was placed in operation in 1958.

DEVELOPMENT

Early History

The first written report concerning this territory was made by John C. Fremont in the account of his expedition of 1843. General William H. Ashley led a party of fur traders into the West from St. Louis in the spring of 1822, and in 1825 established a trading post at Utah Lake known as Fort Ashley. The Provo River and the city of Provo are said to have been named after a trapper named Provost who was in the vicinity of Utah Lake as early as 1820. In March 1849, a group went southward from Salt Lake with the intention of establishing a colony on the Provo River. The settlement, started at a place called Old Fort Field, is now within the city limits of Provo. A fort was built and crops planted: over 200 acres were plowed the first year for wheat, rye, and corn. In August 1850, settlements were made at American Fork, Lehi, and Pleasant Grove.

Investigations

Utah Lake supplied irrigation water for some areas in the Salt Lake Valley; however, during the drought years 1931-35, storage in Utah Lake fell from 850,000 to 20,000 acre-feet. It became apparent that construction of the Provo River Project was essential to provide an adequate water supply. The project plan resulted from extensive investigations conducted at various times after 1922 by the Bureau of Reclamation in cooperation with the Water Storage Commission of Utah. The desperate water shortage experienced by Salt Lake City in the 1930's and the consequent request to the Government for assistance in obtaining a dependable water supply for Salt Lake Valley gave rise to a concerted effort to obtain approval of the Provo River Project. The city of Provo and five other communities in Utah County, as well as Salt Lake City, all needing additional domestic water supplies, joined with the irrigation interests to sponsor the project.

Authorization

Construction of the project was initiated under the provisions of the National Industrial Recovery Act of June 16, 1933, and approved by the President on November 16, 1935, under the terms of subsection B of

section 4 of the act of December 5, 1924 (43 Stat. 701). The Salt Lake Aqueduct was approved by the President on October 24, 1938. Deer Creek Powerplant was found feasible and authorized by the Secretary of the Interior on August 20, 1951, under the Reclamation Project Act of 1939.

Construction

Construction of the project began in May 1938, the first water becoming available in 1941 upon the completion of Deer Creek Dam. Construction of some features of the project was severely hampered by wartime scarcities of manpower, materials, and funds. Work on the Duchesne Tunnel had to be stopped in 1942, although construction continued on a small scale on the canal system and Salt Lake Aqueduct. In 1947, full-scale construction was resumed. Construction of features of the Aqueduct Division was started in 1939 and completed in 1951. The Deer Creek Powerplant was completed in 1958.

Operating Agencies

All features of the Deer Creek Division are operated and maintained by the Provo River Water Users Association. The Metropolitan Water District of Salt Lake City operates and maintains the aqueduct system. The Western Area Power Administration, CRSP Management Center, maintains Project switchyard facilities and markets the power output from the powerplant.

BENEFITS

Irrigation

A supplemental water supply has been provided for 48,156 acres of highly developed farmlands, thus assuring maturity of valuable crops. Principal crops are alfalfa, grain, peaches, apples, pears, sugar beets, and canning crops. such as sweet corn, peas. and tomatoes.

Municipal and Industrial Water

Municipal and industrial water service is provided for the metropolitan water districts of Salt Lake City, Provo, Orem, Pleasant Grove, Lewiston, American Fork, and Lehi. An average annual amount of 73,454 acre-feet is delivered to 343,345 people.

Recreation

Deer Creek Reservoir is on the Provo River about 16 miles northeast of Provo, Utah. Because a main highway crosses the dam, many visitors see

the dam and reservoir during the year. The reservoir provides boating and excellent fishing in season, primarily for perch and native, rainbow, and brown trout. Two boat concessions, each with boats to rent to the public, are located on the shore of the reservoir. Camping, swimming, boating, water skiing, and other forms of recreational use have increased dramatically. The Utah State Division of Parks and Recreation has administering responsibility. A new boat launching ramp, camp, and picnic facilities have been provided. Total visitation to the reservoir during 1977 was 426,290 recreation days.

PROJECT DATA

Land Areas (1977)
Irrigable area:

Supplemental irrigation service - 48,136 acres
Number of irrigated farms - 1,767

	Area Irrigated	Crop Value
Year	Acres	Dollars
1968	40,475	5,338,702
1969	40,288	4,417,168
1970	40,185	5,197,416
1971	40,000	5,136,863
1972	39,600	4,512,696
1973	39,475	8,764,320
1974	39,130	9,982,364
1975	39,032	8,852,339
1976	38,542	9,184,606
1977	37,423	9,493,586

Facilities in Operation

Storage dams - 1
Diversion dams - 4
Canals - 32 mi
Aqueducts - 41.7 mi
Laterals - 3.8 mi
Pumping plants - 1
Powerplants - 1
Transmission lines - 0.4 ml
Substations - 1

Climatic Conditions

Annual precipitation - 15.8 in
Temperature:

Maximum - 110 °F
Minimum - -35 °F
Mean - 49 °F
Growing Season - 124 days
Elevation of irrigable area - 4630.0 ft

Settlement

Number of persons served with project water (1977):
Farm irrigation service - 7,345 acres
Urban, suburban, and industrial service - 336,000 acres
Total - 343,345 acres

ENGINEERING DATA

Water Supply

PROVO RIVER[1]

Drainage area at Vivian Park - 560 mi^2
Annual discharge at Vivian Park:
Maximum (1932) - 427,639 acre-ft
Minimum (1942) - 230,000 acre-ft
Average - 265,900 acre-ft

DUCHESNE RIVER

Drainage area at Duchesne Tunnel - 39 mi^2
Annual discharge at Duchesne Tunnel:
Maximum (1950) - 52,950 acre-ft
Minimum (1931) - 23,600 acre-ft
Average - 39,910 acre-ft

WEBER RIVER

Drainage area 2.6 mi upstream from Weber Provo Diversion Canal heading - 163 mi^2
Annual discharge at 2.6 mi upstream from Weber-Provo Diversion Canal heading:
Maximum (1909) - 294,000 acre-ft
Minimum (1934) - 56,050 acre-ft
Average - 159,400 acre-ft
Average annual diversion (all sources) - 210,750 acre-ft

[1] Natural flow including transmountain diversions and Salt Lake Aqueduct diversions.

Storage Facilities

DEER CREEK DAM

Type: Zoned earthfill
Location: On the Provo River 16 miles north east of Provo, Utah.
Construction period: 1938-41
Date of closure (first storage): 1941

Reservoir, Deer Creek:
Average annual inflow, 1942-53 - 260,400 acre-ft
Total capacity to El. 5,417 - 152,700 acre-ft
Active capacity, El. 5303-5417 - 149,700 acre-ft
Surface area - 2,683 acres
Dimensions:
Structural height - 235 ft
Hydraulic height - 155 ft
Top width - 35 ft
Maximum base width - 1,000 ft
Crest length - 1,304 ft
Crest elevation - 5425.0 ft
Total volume - 2,810,000 yd^3
Spillway: Concrete crest and concrete-lined chute in right abutment, controlled by two 21- by 20-ft radial gates.
Elevation top of gates - 5417.0 ft
Crest elevation - 5397.0 ft
Capacity at El. 5417 - 12,000 ft^3/s
Outlet works: Concrete-lined tunnel through left abutment controlled by two 52-in tube valves in powerplant substructure at outlet end.
Capacity at El. 5417 - 1,500 ft^3/s
Foundation: Interbedded clay, sand, and gravel overlying alternating strata of slightly broken but firm sandstone and limestone.
Special treatment: Cement grout curtain beneath cutoff walls; supplemental grouting of abutments.

Diversion Facilities

DUCHESNE DIVERSION DAM

Type: Rockfill weir, concrete-core wall
Location: On the North Fork, Duchesne River. about 30 miles east of Heber, Utah.
Year completed: 1952
Dimensions:
Structural height - 23 ft
Hydraulic height - 17 ft
Weir crest length - 270 ft
Total crest length - 480 ft
Weir crest elevation - 8109.73 ft
Volume - 10,000 yd^3
Sluiceway: Concrete gated structure, one10-by 13-ft radial gate, at right abutment of dam.
Headworks: Diverts directly into Duchesne Tunnel through tunnel intake at right abutment of dam.
Diversion capacity - 600 ft^3/s

MURDOCK DIVERSION DAM

Type: Concrete ogee weir, embankment wing
Location: On the Provo River, about 6 miles north of Provo, Utah.
Year completed: 1950
Dimensions:
Structural height - 22 ft
Hydraulic height - 19 ft
Weir crest length - 100 ft
Total crest length - 370 ft
Weir crest elevation - 4885.5 ft
Volume - 9,000 yd^3
Sluiceway: Concrete gate structure, one 16- by 14-ft radial gate at left side of dam.
Headworks: Concrete, one 16- by 13-ft radial gate. Revolving fish screen 40 ft upstream from gate.
Diversion capacity - 550 ft^3/s

WEBER-PROVO DIVERSION DAM

Type: Concrete ogee weir, embankment wings
Location: On the Weber River about 1 mile east of Oakley, Utah.
Year completed: 1930
Dimensions:
Structural height - 25 ft
Hydraulic height - 19 ft
Weir crest length - 150 ft
Total crest length - 1,795 ft
Weir crest elevation - 6488.55 ft
Volume - 15,000 yd^3
Sluiceway: Adjacent to left end of overflow section, controlled by two 5-by 6-ft slide gates.
Headworks: Concrete, six 5- by 6-ft slide gates, at right angles to dam and adjacent to sluiceway.
Diversion capacity - 1,000 ft^3/s

BROADHEAD DIVERSION DAM

Type: Concrete ogee weir, embankment wings
Location: On Broadhead Creek, about 23 miles east of Kamas, Utah.
Year completed: 1953, replaced 1964. [2]
[2] Replaces previous Reclamation-constructed dam of the same name.
Dimensions:
Structural height - 8 ft
Hydraulic height - 5 ft
Weir crest length - 13 ft
Total crest length - 28 ft
Weir crest elevation - 8198.0 ft
Volume - 700 yd^3
Sluiceway: At left side of dam, controlled by 3-by 4-ft slide gate.

Headworks: 30-in-diameter precast concrete pipe, controlled by 30-in-diameter slide gate.
Diversion capacity - 22 ft^3/s

Carriage Facilities

DUCHESNE TUNNEL

Location: From point of diversion on the Duchesne River generally west 6 mi to a point about 14 mi east of Kamas, Utah.
Construction period: 1940-42
Concrete lined in 1949-52
Length - 6 mi
Capacity - 600 ft^3/s
Cross section: Horseshoe
Diameter 9.23 ft
Lining: Concrete

PROVO RESERVOIR CANAL

Location: From Murdock Diversion Dam on the Provo River about 6 miles north of Provo, Utah, generally northwest 23 miles to a point about 6 miles south of Draper, Utah.
Construction period: Non-Reclamation construction. Enlarged by Reclamation in 1940-50.
Length - 23 mi
Diversion capacity - 530 ft^3/s
Typical maximum section in earth:
Bottom width - 18 ft
Side slopes - 1.25:1
Water depth - 5.68 ft
Typical maximum section, concrete lined:
Bottom width - 14 ft
Side slopes - 1.25:1
Water depth - 4.34 ft
Lining thickness - 4 in

SALT LAKE AQUEDUCT

Location: From Deer Creek Dam generally southwest along the Provo River to a point 7 miles north of Provo. Utah, then generally north to Salt Lake City.
Construction period: 1939-51
Description: Concrete pipeline
Length - 41.7 mi
Diameter - 69 in
Capacity - 150 ft^3/s

ALPINE-DRAPER TUNNEL

Location: 20 miles northwest of Provo, Utah.
Construction period: 1938-41
Length - 15,037 ft
Capacity - 150 ft^3/s

Cross section: Horseshoe
Diameter - 6.5 ft
Lining: Concrete

OLMSTED TUNNEL

Location: 7 miles north of Provo, Utah.
Construction period: 1938-41
Length - 3,614 ft
Capacity - 130 ft^3/s
Cross section: Horseshoe
Diameter - 6.3 ft
Lining: Concrete
Thickness - 3-7 in

TERMINAL RESERVOIR (SALT LAKE AQUEDUCT)

Location: In the southeast portion of metropolitan Salt Lake City.
Description: The principal features of the Terminal Reservoir are the automatic wasteway, the Venturi meter structure and the chlorination and control house, the Sam Park Reservoir inlet control structure, [3] the two 61.4-acre-ft storage units, and the influent and effluent piping system.
[3] Sam Park Reservoir built by private interests.
Dimensions (each storage unit):
Structural height - 30.3 ft
Top width - 271.8 ft
Top length - 418.8 ft
Side slopes - 1.3:1
Total concrete in storage units and appurtenant structures - 16,215 yd^3

WEBER-PROVO DIVERSION CANAL

Location: From the Weber River at a point about 1 mile east of Oakley, Utah, generally south 9 miles to the Provo River.
Construction period: Originally constructed in 1929-30 as a part of the Weber River Project. Enlarged in 1941-47 under the Provo River Project.
Length - 9 mi
Capacity - 1,000 ft^3/s
Typical maximum section in earth:
Bottom width - 24 ft
Side slopes - 2:1
Water depth - 7.3 ft
Typical maximum section, concrete lined:
Bottom width - 12 ft
Side slopes - 1.75:1
Water depth - 6.37 ft
Lining thickness - 4 in
Typical maximum section, compacted earth lining:
Bottom width - 24 ft
Sideslopes - 1.75:1

Water depth - 7.3 ft
Lining thickness on bottom - 2 ft
Measured horizontally, on sides - 8 ft

SOUTH LATERAL

Location: From outlet Jordan Narrows Pumping Plant, generally south 3.8 mi.
Construction period: 1949-50
Length - 3.8 mi
Capacity - 40 ft^3/s
Typical maximum section in earth:
Bottom width - 6 ft
Side slopes - 1.3:1
Water depth - 2.2 ft
Typical maximum section, concrete lined:
Bottom width - 3 ft
Side slopes - 1.5:1
Water depth - 2.2 ft
Lining thickness - 4 in

JORDAN NARROWS PUMPING PLANT

Number of units - 1
Total capacity - 65 ft^3/s
Total dynamic head - 103 ft
Total horsepower - 1,050

Power Facilities

DEER CREEK POWERPLANT

Location: At Deer Creek Dam.
Year of initial operation: 1958
Nameplate capacity - 4,950 kW
Number and capacity of generators: Two at 2,475 kW each
Maximum head - 140 ft
Gross generation (1977) - 24,580,000 kWh

SUBSTATIONS

Number in operation - 1
Total capacity of transformers - 6,250 kVA

TRANSMISSION LINES

Designation: Deer Creek Powerplant - Pacificorp, Utah Power Tie Line.
Capacity - 12.5 kV
Power capacity - 5,000 kW
Circuit miles - 0.4
Year placed in service - 1990

This web page was adapted from portions of a Bureau of Reclamation Project Data book dated May, 1981.

[redacted]

In this section:

Water Report Public Hearings About Jordan Valley Water Information
Water Conservation District News How to Contact Jordan Valley

How you got here.

[Jordan Valley] [JVWCD] [Map]

Upper Provo River Reservoirs. Historically, these Upper Uinta lakes were converted to small storage reservoirs. Jordan Valley Water Conservancy District is a major stockholder in these lakes, the majority of which have now been rehabilitated and the storage right moved to Jordanelle Reservoir.

2 Weber/Provo Rivers Diversion Canal. A 12-mile canal with a capacity of 1,000 cfs that conveys water from rights on the Weber River and Echo Reservor to JVWCD. The canal is also used by the Provo River Water users association (PRWUA) for the diversion of Weber River water to supply Dear Creek Reservoir.

3 Jordanelle Reservoir. (storage capacity: 320,000 acre-feet (AF). As a feature of the Bonneville Unit, Jordanelle Reservoir collects Central Utah Project (CUP) water rights from the Provo River. JVWCD anticipates a 50,000 AF/year supply from Jordanelle Reservoir.

4 Deer Creek Reservoir. (storage capacity: 152,000 AF). This reservoir is a feature of the Provo River Project. JVWCD owns stock in the Provo River Water Users Association, which entitles it to water stored in this reservoir.

5 Salt Lake Aqueduct. This 69-inch diameter pipe, operated by Metropolitan Water District of Salt Lake City, conveys Prover River water from Deer Creek Reservoir to service areas of Jordan Valley, Salt Lake City and Sandy City.

6 Southeast Regional Water Treatment Plant. Jordan Valley's 20 million gallon per day (MGD) facility treats water from the Salt Lake Aqueduct and local mountain streams.

7 Little Cottonwood Treatment Plant. Metropolitan Water District of Salt Lake City's 100 MGD plant delivers treated water to Jordan Valley, Salt Lake City and Sandy City service areas.

8 Well Field. This high-quality aquifer is the source of groundwater for Jordan Valley and many municipalities.

9 Jordan Aqueduct. This 78-inch pipe conveys water from Deer Creek and Jordanelle reservoirs to Jordan Valley Water Treatment Plant. Lower portions of the aqueduct transmit treated water to the Jordan Valley and Metropolitan Water District service areas.

10 Jordan Narrows Pumping Station. This station pumps Utah Lake water into the

Welby and Jacob canals for irrigation purposes.

11 Jordan Valley Water Treatment Plant. (treatment capacity: 180 MGD). This drinking water plant is operated by JVWCD and supplies water to many of the JVWCD member agencies. It is the largest treatment plant in Utah.

12 Reservoirs and Pump Stations. These facilities store water and pump it to JVWCD's customers.

13 Jordan Aqueduct Terminal Reservoir. This 100 million gallon drinking water reservoir is the largest in Utah.

Main Navigation Links:

Jordan Valley Home Page Water Report Public Hearings About Jordan Valley Water Information Water Conservation District News How to Contact Jordan Valley

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Contact Us: Info@jvwcd.org

Bulletin Board

Deer Creek Dam Testing

Bureau of Reclamation studies 59 year old dam

August 18, 2000

The U.S. Bureau of Reclamation ("Reclamation") is near completion of subsurface drilling and coring work on Deer Creek Dam located in Provo Canyon, Utah (US Highway 189), southeast of Heber City. "The work is part of the Reclamation's Safety of Existing Dams Program," says G. Keith Denos, General Manager of the Provo River Water Users Association ("PRWUA"), sponsor of the 1935 Provo River Project that includes the dam. The final report is due later this year. "Reclamation began the work in the fall of 1998 and expected it to be completed the next year, but the work carried over an additional year," adds Denos.

Drilling rig at work at Deer Creek Dam. The powerhouse is in the background and the overflow channel to the right. Completed in 1941, the dam and reservoir provide water to shareholders in Utah and Salt Lake Counties.

Reclamation constructed Deer Creek dam between 1938 and 1941. The structure stands 235 feet high from bedrock and 155 feet above the stream bed. The dam extends 1,300 feet between the canyon walls at the crest level. It is 1,000 feet wide at the base and 35 feet wide at the highway level. The dam was constructed with 3,000,000 cubic yards of earth and rock. When filled, Deer Creek Reservoir holds 152,000 acre-feet of water. At the time of construction it was the third largest earth-fill dam built by Reclamation.

The water supply for the reservoir comes from diversions on the Weber and Duchesne Rivers and surplus flows in the Provo River. The Weber River diversion water is conveyed via the Weber-Provo River Canal across the Kamas Bench and the Duchesne diversion water through the transbasin Duchesne Tunnel to the Provo River drainage. At the base of the dam is the Deer Creek powerplant owned by Reclamation and operated by PRWUA under contract with Reclamation. Other features of the project include the Murdock diversion works at the mouth of Provo Canyon and the Provo Reservoir Canal that conveys project water to shareholders in Utah and Salt Lake Counties.

The Metropolitan Water District of Salt Lake and Sandy ("District') is the majority shareholder in the project with 61,700 of the 100,000 shares, which normally provides 61,700 acre-feet of water supply on an annual basis. The

District provides M&I water to its member cities, Salt Lake City and Sandy City, and surplus water to the Jordan Valley Water Conservancy District.

Deer Creek dam is the fourth dam studied within the state of Utah. So far Lost Creek, Pine View, and Echo dams have been studied. According to Denos, Reclamation is doing the subsurface exploration work to make sure the foundation is stable based on modern modeling technology. The modeling will determine if the dam structure can withstand a major seismic event. Denos notes that there is no known problem with the dam structure. "Deer Creek is classified as a high hazard dam because of the large population situated downstream from the reservoir. The current drilling work will provide the necessary information to ensure the dam's safety," exclaims Denos.

Planning is underway to widen US 189 in Provo Canyon. The dam may see additional fill to accommodate this project, changing its appearance to the thousands of travelers who pass this Reclamation project.

UTAH ASSOCIATION OF COUNTIES

Wasatch County

Area: 1,191 square miles; population: 10,089 (in 1990); county seat: Heber City; origin of county name: from the Wasatch Mountains; principal cities/towns: Heber City (4,782), Midway (1,554), Charleston (336), Wallsburg (252); economy: hay, livestock, recreation; points of interest: Strawberry, Deer Creek, and Jordanelle reservoirs, Wasatch Mountain State Park, Wasatch LDS Tabernacle in Heber City, Heber Creeper, historic homes in Midway. Heber Valley, one of several back valleys in the Wasatch Mountains, is often called Utah's Switzerland because of the rugged beauty of Mount Timpanogos located to the west, its climate, and a large population of Swiss that settled in Midway. The county's highest peaks top 10,000 feet, and over half of the land is 7,500 feet above sea level. The climate zone, classified as undifferentiated highlands, offers cool summers and very cold winters. The average annual precipitation is about sixteen inches.

The county is divided into two watersheds--the Colorado and the Great Basin drainage systems. Because of its annual precipitation and its location between the Uinta and Wasatch mountains, Heber Valley is well endowed with water. Flowing from the east are Daniels, Lake Fork, and Center creeks. From the north and northeast is the Provo River. From the west Snake Creek drains a central portion of the Wasatch Mountains. Two additional sources of water are man-made: the Ontario Drain Tunnel west of Keetley drains many of the Park City mines, and the Weber/Provo diversion canal diverts water from the Weber across the Kamas prairie in Summit County to the Provo River in Wasatch County.

Prior to the 1850s, Heber Valley was an important summer hunting ground for the Timpanogos Utes living around Utah Lake. The first white men to visit the county were members of the Dominguez-Escalante expedition in 1776. They skirted Heber Valley, traveling down Diamond Fork to Spanish Fork Canyon and then into Utah Valley. Fifty years later fur trappers entered the county. In 1824 and 1825 Etienne Provost from Taos, New Mexico, trapped beaver in the Uinta

and Wasatch mountains. About the same time, William Henry Ashley and members of his fur company from St. Louis also hunted and trapped for beaver in the county.

The first settlers came into Wasatch County from Utah Valley in the spring of 1859 and located a short distance north of present Heber City at the London or John McDonald Spring. That same year, Midway and Charleston were also settled. In 1862 the territorial legislature created Wasatch County, which then included all of the Uinta Basin. Wasatch in Ute means "mountain pass" or "low pass over high range." Heber City, named for Mormon Apostle Heber C. Kimball, was selected as the county seat. The last boundary change occurred in 1914 when Duchesne County was created out of the eastern half of Wasatch County.

The county produces hay, dairy products, sheep and cattle. During the early 1900s, after the Denver and Rio Grande Railroad completed a line into the county from Provo, Heber City became an important shipping terminal for wool and sheep. In 1922 the Union Pacific Railroad constructed a spur from Park City to the mines west of Keetley. Lead, zinc, and silver ore were shipped from these mines on this railroad spur. Today neither railroad line is in full operation, and other economic activities are more important to the county than transportation and mining.

Strawberry Reservoir (completed in the 1910s), Deer Creek Reservoir (completed in the 1940s), and Jordanelle Reservoir (scheduled for completion in the 1990s), together with sparkling streams and beautiful mountain scenery, have made Wasatch a popular recreation area. The county provides excellent opportunities for fishing, boating, and other summer and winter outdoor activities. Also, Heber Valley increasingly is becoming the home for many people who work in Utah Valley, Park City and Salt Lake City.

Craig Fuller

1.0 SUMMARY OF STUDY PURPOSE, MODEL SCOPE, AND RELATIONSHIP TO OTHER STUDIES

This report documents a Hydrologic Model Analysis of the Provo River Basin conducted by the Central Utah Water Conservancy District (CUWCD). The study documented herein resulted in the development of a computer model called PROSIM (the Provo River Simulation Model) that simulates the Provo River system, including the Weber River, Utah Lake, and transbasin diversions into the Provo drainage.

The purpose of this document is to provide an understanding of the following:

1.0 The objectives and purpose for this study and the capabilities of PROSIM
2.0 The public involvement program and the analyses performed in the development of PROSIM
3.0 Model results from the analysis of historical conditions
4.0 Model results from the analysis of proposed demand conditions
5.0 Future plans for the use of PROSIM

Each of these topics is covered in the correspondingly numbered section of this report. Summaries of 1) transbasin diversion rights from the Weber River and 2) the "public involvement" in the preparation of this report are included in the appendices.

1.1 Authorization

The Central Utah Project (CUP) was originally authorized in 1956 as part of the Colorado River Project Storage Act. The entire project consists of five units in the Uinta Basin of the Colorado River and one unit that includes parts of the Colorado Basin and parts of the Great Basin. This last unit, the Bonneville Unit, includes the Provo River system.

The Central Utah Project Completion Act (CUPCA) is a part of PL102-575. CUPCA was signed into law by the President of the United States on October 30, 1992. CUPCA authorizes CUWCD to complete the remaining features of the Central Utah Project. The Completion Act is multi-faceted and includes requirements for CUWCD and/or the Utah Reclamation Mitigation and Conservation Commission (URMCC) to complete several separate features, including six studies of areas of the Provo River drainage and Utah Lake, collectively designated by CUWCD as Provo River/Utah Lake Special Studies.

The CUWCD provided funding for this Hydrologic Model Analysis project under authority of CUPCA, Section 202(a)(5)(A)(i), as part of the Provo River/Utah Lake Study of the Central Utah Project Special Studies Program. The authorizing legislation states,

...the District (is) to conduct with Public Involvement a hydrologic study that includes a hydrologic model analysis of the Provo River with all tributaries, water imports and exports and diversions, an analysis of expected flows and storage under varying water conditions, and a comparison of steady state conditions with proposed demands being placed on the river and affected resources, including historic diversions, decrees, and water rights....

1.2 Study Objectives and Purpose

As decreed by the authorizing legislation, the objectives of this Hydrologic Model Analysis of the Provo River Basin are to develop a comprehensive understanding of the hydrology, water rights, and operation of the Provo River system, and to translate that understanding into an effective planning tool that can be used to perform studies of the operation of the system. Specific objectives were developed for the

Hydrologic Model Analysis of the Provo River Basin

Name of Study	Purpose	Relationship to this Study
Wasatch County Water Efficiency Project (WCWEP)	Evaluate and implement irrigation efficiency improvements and acquire Strawberry Basin water rights which will increase instream flows	Uses PROSIM in evaluating environmental impacts on water and other resources
Utah Lake Salinity Control Studies (ULSCS)	Reduce impacts of CUP upon Utah Lake salinity levels	This Hydrologic Model Analysis uses certain Utah Lake data developed by ULSCS.
Strawberry-Provo Conveyance Studies (SPCS)	Evaluate feasibility of direct delivery of Colorado Basin water to the Provo River Basin; analyze hydrology of Provo River.	This Hydrologic Model Analysis was started within the SPCS, but then evolved into a separate study effort using a different period of record due to availability of data.
Increased Project Water Studies	Acquire water rights to augment instream flows on the Lower Provo River	These studies may use PROSIM in evaluating alternatives, environmental impacts and instream flow benefits
Provo River Excess Flow Study	Reduce or mitigate the impacts of Provo River high flows on fisheries and recreation	This study may use PROSIM in evaluating alternatives, impacts, and benefits
Provo River Diversion Dams	Evaluate measures to retain increased instream flows within the Provo River channel below Olmsted	This study may use PROSIM in evaluating alternatives, impacts, and benefits

2.0 CONDUCT OF THE STUDY, DEVELOPMENT OF THE MODEL, AND THE PUBLIC INVOLVEMENT PROCESS

This Hydrologic Model Analysis of the Provo River Basin was initiated in January 1992, with the development of a conceptual model study. During this phase, a Technical Advisory Committee (TAC) was formed to provide public involvement and technical guidance. The TAC was involved during each of the remaining phases of the project, including analysis of Provo River hydrology and water rights, analysis of Weber River hydrology and water rights, and software development and calibration. Each of these phases is described in the following subsections.

2.1 Conceptual Model Development

The first step in conducting the Hydrologic Model Analysis of the Provo River Basin was the development of a conceptual format for the resultant computer model. This formulation step included the collection of basic data on the physical and institutional setting of the system, the formation of a public involvement program (described in section 2.2), and the development of objectives, limitations, and specifications for the computer software. The conceptual model development phase was concluded with the preparation of a revised draft Technical Memorandum #1 - Conceptual Model Development (CUWCD, 1992a).

2.1.1 Data Collection

Wasatch County Water Efficiency Project is not modeled.

4.2 Streamflow Results

Simulated streamflow results under the Proposed Demands Scenario appear reasonable and consistent with expectations. Key results are tabulated below.

Table 4-4

Key Simulated Streamflow Results in cfs

Proposed Demands Scenario

Location	Minimum Flow	Average Flow	Maximum Flow	Comments
Hailstone Gage	14	321	2,682	
Jordanelle Outflow	125	342	2,373	IFR = 125 cfs
Inflow to Deer Creek	144	371	2,211	
Deer Creek Outflow	108	450	2,476	IFR = 100 cfs
Below Olmsted	5	126	1,897	Winter IFR = 25 cfs
Provo City Gage	0	118	2,112	Winter IFR = 25 cfs

PROSIM-produced 40-year hydrographs from the Proposed Demands Scenario are presented in Figures 4-2 through 4-4.

4.3 Reservoir Contents Results

Simulated reservoir contents results under the Proposed Demands Scenario were developed for the Head of River, Jordanelle, Deer Creek, Echo, East Canyon reservoirs, and Utah Lake. Key results are tabulated below.

Table 4-5

Key Simulated Reservoir Storage Results in Acre-Feet

Proposed Demands Scenario

Reservoir	Minimum Storage	Average Storage	Maximum Storage	Inactive Storage
Head of River (lumped)	11,400	13,100	15,000	9,960
Jordanelle	37,500	239,700	314,000	3,000
Deer Creek	20,400	116,100	152,400	3,000
Utah Lake	262,800	668,800	1,296,300	160,000

Reservoir storage hydrographs for Jordanelle, Deer Creek, and Utah Lake are presented in Figures 4-5 through 4-7.

4.4 Water Supply and Transbasin Diversion Results

Simulated water supply and transbasin diversion results under the Proposed Demands Scenario appear reasonable and consistent with expectations. Key results are tabulated below.

Table 4-6

Key Simulated Average Annual Diversion Results in Acre-Feet

Proposed Demands Scenario

Diversion or Water User	Demand	Diversion	Maximum Shortage	Comments
Weber-Provo Canal	N/A	59,500	N/A	
Duchesne Tunnel	N/A	33,200	N/A	
Wasatch Division Direct Flow Rights (lumped)	98,600	95,500	12,000	Includes some demands that exceed rights. The total of water rights limited by demand equals 96,000 acre-ft/year.
Central Utah Project	107,500	107,500	0	
Provo River Project	100,000	96,600	68,500	
Provo Division Direct Flow Rights (lumped)	44,400	38,600	20,100	Includes some demands that exceed rights. The total of water rights limited by demand equals 38,800 acre-ft/year.
Utah Lake Users	196,700	196,700	0	
Strawberry-Utah Lake	N/A	28,600	N/A	

PRP and CUP demands and simulated diversions are compared in Figures 4-8 and 4-9. The shortages shown on Table 4-6 for Heber Valley and Provo Division direct flow water users are due primarily to historical demands that exceeded users' rights. Other simulated diversions closely match user demands.

4.5 Conclusions Regarding the Proposed Demands Scenario Simulation

The PROSIM simulation of the Provo River system under historical hydrological and proposed demands and operating conditions has provided useful information on future Provo River water resources conditions. However, the simulated results are only as good as the assumptions used in developing the model and the scenario. If a different set of demands were applied, or a different priority was used for a critical water rights assumption, the simulated results might have been significantly different. In interpreting these results, it is also important to keep in mind that PROSIM is 100 percent efficient, whereas real-world river operations are not. In other words, while PROSIM is capable of allocating every drop of water on the river, in actual practice there is significant waste or inefficiency in operating the system. Thus PROSIM's results may tend to be somewhat "best case" approximations.

With this in mind, the most important conclusion reached from the simulation of the proposed demands scenario is that all of the Central Utah Project demands are met throughout the simulation period. The average annual "design" yield of 107,500 acre-feet per year is satisfied, with a minimum remaining storage of 46,100 acre-feet in Jordanelle.